(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 407 221 B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: 31.03.93 Bulletin 93/13

(51) Int. Cl.[5]: B64D 33/02, F02C 7/042

(21) Application number: 90307434.2

(22) Date of filing: 06.07.90

(54) **Variable air intake.**

(30) Priority: 06.07.89 GB 8915481

(43) Date of publication of application: 09.01.91 Bulletin 91/02

(45) Publication of the grant of the patent: 31.03.93 Bulletin 93/13

(84) Designated Contracting States: DE FR GB IT SE

(56) References cited:
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Description

This invention relates to a variable air intake for an aircraft or the like, and in particular to such an intake comprising a number of ramp members that may be moved to vary the geometry of the intake.

In order to optimise air intake efficiency over a range of speeds, it is known to provide intakes of variable geometry, different intake configurations being more suited for different speeds examples of this prior art US-A-4372505 and GB-A-1190812. One known way of achieving this is to provide the intake with a number of pivotally interconnected ramps that may be moved, for example by means of a drive screw, to vary the inner dimensions of the intake. The intake structure, including the ramp members, may be made from non-metallic materials to protect the intake from high temperatures. Drive screws, however, must still be made of steel or titanium, and in certain ramp positions portions of such drive screws may be exposed disadvantageously to high temperature intake air. It would be beneficial to protect such drive screws or other types of drive means from damage caused by the impingement of hot air. In addition, exposed drive screws can also cause unwanted turbulence by spoiling the smooth flow of air in the intake.

According to the present invention there is provided a variable air intake comprising a ramp member movable by drive means to alter the configuration of said intake, said intake further comprising a thermal shield member movable with said ramp member to shield a portion of the drive means that would otherwise be exposed by movement of the ramp member.

In a particularly preferred embodiment the ramp member is fixed at one end to a carriage mounted for linear movement on a drive screw, and said shield member comprises a substantially continuous thermal blind fixed to and movable with said carriage to shield said drive screw.

Preferably the blind is fixed to both ends of the carriage and is guided by guide means, including blind tensioning means, so as to move with the carriage. The guide means may be formed integrally with the intake structure. The blind tensioning means may comprise, for example a tensioning pulley or roller.

In a particularly preferred embodiment the ramp member may be driven by two carriages mounted on separate drive screws with a fairing member spanning said carriages to the rear of the ramp member, and each carriage and each drive screw being provided with a separate shield member.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Figure 1 is a diagrammatic plan view on a variable air intake arrangement.

Figure 2 is a plan view of a rearward part of a variable air intake,

Figure 3 is a section through A-A of Figure 2,

Figure 4 is a section through B-B of Figure 2,

Figure 5 is a section through C-C of Figure 2,

Figures 6 and 7 are schematic perspective views showing the movement of the thermal shield member, and

Figure 8 is a perspective view of the intake shown in Figure 2.

The intake shown in Figures 1 & 2 are an identical dual intake arrangement disposed symmetrically about the longitudinal centre line 1, however only one side will be described in detail.

Referring to the drawings, figure 1 illustrates diagrammatically a plan view through one half of a dual air intake arrangement 20 incorporated into a flight vehicle (not shown) and includes an air intake opening 21 whose opening is defined by a fixed ramp 22 and an intake lip 23. The air intake control system includes a variable ramp arrangement comprising a series of inter-connected ramp panels, the most rearward panel 2 having a pivotal attachment 4 to ramp actuating drive screw means 7 as hereinafter described. By this means the geometry of the air intake ramps may be varied to provide optimised air intake flow to match propulsion engine demand.

Figure 2 shows the ramp 2 in its two extreme positions (2, 2'). The ramp 2 is pivotally fixed at its forward end 3 to a further intake defining ramp member (not shown), and is pivotally fixed at its rearward or aft end to a travelling fairing 5, which in turn is fixed to a carriage 6. The carriage 6 incorporates a trunnion engaging a drive screw 7, the drive screw 7 being supported for rotation by a bearing support 8 at one end and being in driving engagement with a gear box 9 at the other end. By means of an input drive shaft 10 to the gear box 9, the screw 7 is caused to rotate. It will be appreciated that rotation of the drive screw 7 causes the carriage 6 to move linearly between its extreme positions with consequent movement of the ramp 2.

The drive screw 7, gear box 9 and support bearing 8 are all housed within an integral structural unit 17 formed on the side of the longitudinal centre line 1. Included in this unit 17 is a track 12 defined by flange members 18 on which the carriage 6 is guided by means of rollers 11 (also shown in Figures 4 and 5).

In Figure 2 the left-hand side of the drawing corresponds to upstream with respect to air drawn into the intake duct. It will be noted therefore that when the carriage and ramp are in the extreme upstream position (6', 2'), to produce a steep ramp angle, there is a portion of the drive screw 7 that would be exposed to potentially hot intake air flowing in the direction of the arrow in Figure 2 over the ramp and fairing. The ramp, fairing and fixed structure of the intake may be made of non-metallic materials, for example ceramics, but the drive screw may need to be made

of steel or titanium. In order to protect the drive screw 7 from damaged caused by the impingement of hot air, a thermal protection blind 13 is provided connected to both ends of the carriage 6. The blind is guided from the upstream carriage end by pulleys 14 around the gearbox, and by a guide member 15, formed integrally with the structural unit 17, over the drive screw 7 and around the bearing support 8 to the downstream side of the carriage 6. In the region of the carriage, that is to say on the potentially exposed side of the drive screw 7, the blind is guided and supported by opposed flanges 19 defining a blind locating space with the track defining flange members 18. This guide means structure not only guides the blind, but also provides support for the blind to react against fluid pressure upon it. The blind 13 is tensioned by tensioning means 16 associated with one of the rollers 14 and including a tensioning member 19' fixed at one end to guide 15. The combination of the guide structure and the tensioning means ensures that the blind moves smoothly together with the carriage to which it is attached.

Operation of the ramp mechanism, and in particular the thermal blind, is best understood with reference to Figures 6 and 7. Figure 6 shows the carriage 6 in its most downstream position with a shallow ramp angle. In this position there is no need to provide thermal protection for the drive screw since the ramp itself will shield the screw. However, as the carriage moves upstream (ie, to the left in the Figures), to increase the ramp angle, the blind 13 downstream of the carriage is drawn to close off the space vacated as a result of ramp movement and provides an effective thermal barrier to the otherwise exposed drive screw, this region being illustrated by the shaded area in Figure 7.

The blind 13 is, naturally, made of a heat resistant material, such as a ceramic material. It is not, however, necessary for the whole blind to be made of a heat resistant material; it may only be necessary for that portion forming the barrier to be of such material.

The ramp 2 may be driven by a dual actuation arrangement with two carriages driven on parallel drive screws. Figure 8 illustrates such an arrangement and shows two exposed blind portions 13. A single fairing 5 may span both drive screws and extend the overall width of the ramp. Figure 8 also illustrates that in addition to providing thermal protection for the drive screws, the blinds also serve to define a smooth surface for air flow into the aft spill duct and limiting the generation of turbulence.

The remainder of the blind not providing thermal protection may be used solely for blind tensioning, or in addition as a rudimentary pressure seal, should ducted cooling air or gas be considered necessary to augment the temperature control of each drive screw.

The thermal blind is preferably made of a ceramic based material, and is stiff in the vertical sense and flexible in plan form. The blind may, for example, comprise a number of hingedly connected sections.

Claims

1. A variable air intake, (20) comprising a ramp member, (2) movable by drive means, (7) to vary the geometry of said intake, characterized by said intake, (20) further comprising a thermal shield member, (13) movable with said ramp member, (2) to shield a portion of the drive means that would otherwise be exposed by movement of the ramp member.

2. A variable air intake according to Claim 1 wherein said ramp member, (2) is fixed at one end to a carriage, (6) mounted for linear movement on a drive screw, (7) and said shield member comprises a thermal blind, (13) fixed to and movable with said carriage, (6) to shield said drive screw when the carriage is moved in one direction.

3. A variable air intake according to Claim 2 wherein said blind, (13) is fixed to both ends of said carriage and is guided therebetween by guide means, (18,19).

4. A variable air intake according to Claim 3 wherein said carriage, (6) and said drive screw, (7) are located within a structural housing, (17) and said guide means, (15,18,19) are formed integrally with said housing.

5. A variable air intake according to Claim 4 wherein said guide means, (15,18,19) includes means for supporting at least that portion of the blind that is subjected to an intake air flow.

6. A variable air intake according to any of Claims 2 to 5 comprising blind tensioning means, (16,19').

7. A variable air intake according to any of Claims 2 to 6 wherein said ramp member, (2) is driven by two said carriages, (6) mounted on respective parallel drive screws, (7) a fairing member spanning said carriages.

8. A variable air intake according to any preceding claim wherein said shield member, (13) comprises at least a portion of ceramic based material.

Patentansprüche

1. Variabler Lufteinlaß (20) mit einem Rampenkörper (2), der durch einen Antrieb (7) beweglich ist, um die Geometrie des Einlasses zu ändern,

dadurch gekennzeichnet, daß der Einlaß (20) außerdem einen thermischen Abschirmkörper (13) aufweist, der mit dem Rampenkörper (2) beweglich ist, um einen Teil des Antriebs abzuschirmen, der sonst durch die Bewegung des Rampenkörpers freigelegt würde.

2. Variabler Lufteinlaß nach Anspruch 1, bei welchem der Rampenkörper (2) an einem Ende an einem Schlitten (6) befestigt ist, der linear auf einer Antriebsspindel (7) beweglich gelagert ist und der Abschirmkörper aus einem thermischen Abschirmblendenband (13) besteht, das an dem Schlitten (6) befestigt und mit diesem beweglich ist, um die Antriebsspindel abzuschirmen, wenn der Schlitten in der einen Richtung bewegt wird.

3. Variabler Lufteinlaß nach Anspruch 2, bei welchem die Abschirmblende (13) an beiden Enden des Schlittens befestigt und zwischen den Befestigungen über Führungen (18,19) geleitet ist.

4. Variabler Lufteinlaß nach Anspruch 3, bei welchem der Schlitten (6) und die Antriebsspindel (7) innerhalb eines Gehäuseaufbaus (17) gelagert sind und die Führungsmittel (15,18,19) integral mit dem Gehäuse ausgebildet sind.

5. Variabler Lufteinlaß nach Anspruch 4, bei welchem die Führungsmittel (15,18,19) Mittel aufweisen, um wenigstens jenen Teil der Blendenabschirmung abzustützen, der einer Lufteinlaßströmung ausgesetzt ist.

6. Variabler Lufteinlaß nach einem der Ansprüche 2-5, welcher eine Blendenbandspannvorrichtung (16,19') aufweist.

7. Variabler Lufteinlaß nach einem der Ansprüche 2-6, bei welchem der Rampenkörper (2) durch zwei Schlitten (6) angetrieben wird, die auf parallel zueinander angeordneten Antriebsspindeln (7) laufen, wobei eine Verkleidung die Schlitten überspannt.

8. Variabler Lufteinlaß nach einem der vorhergehenden Ansprüche, bei welchem der Abschirmkörper (13) wenigstens teilweise aus einem auf Keramik basierenden Material besteht.

Revendications

1. Entrée d'air variable (20) comprenant un élément de rampe (2) pouvant être déplacé par un moyen d'entraînement (7) de façon à faire varier la géométrie de ladite entrée, caractérisée en ce que ladite entrée (20) comporte en outre un élément de bouclier thermique (13) mobile avec ledit élément de rampe (2) de façon à protéger une partie du moyen d'entraînement qui, dans le cas contraire, serait exposée par le déplacement de l'élément de rampe.

2. Entrée d'air variable selon la revendication 1, dans laquelle ledit élément de rampe (2) est fixé à l'une de ses extrémités à un chariot (6) monté pour déplacement linéaire sur une vis d'entraînement (7) et ledit élément de bouclier comporte un écran thermique (13) fixé audit chariot (6) et mobile avec lui pour protéger ladite vis d'entraînement lorsque le chariot se déplace dans une direction.

3. Entrée d'air variable selon la revendication 2, dans laquelle ledit écran (13) est fixé aux deux extrémités du dit chariot et guidé entre elles par un moyen de guidage (18, 19).

4. Entrée d'air variable selon la revendication 3, dans laquelle ledit chariot (6) et ladite vis d'entraînement (17) sont situés à l'intérieur d'un logement structurel (17) et ledit moyen de guidage (15, 18, 19) est en une pièce avec ce logement.

5. Entrée d'air variable selon la revendication 4, dans laquelle ledit moyen de guidage (15, 18, 19) comprend un moyen pour supporter au moins la partie de l'écran qui est soumise à l'écoulement de l'air d'entrée.

6. Entrée d'air variable selon l'une quelconque des revendications 2 à 5, comprenant un moyen (16, 19) pour exercer une traction sur l'écran.

7. Entrée d'air variable selon l'une quelconque des revendications 2 à 6, dans laquelle ledit élément de rampe (2) est entraîné par deux desdits chariots (6) montés sur des vis d'entraînement (7) parallèles, respectives, un élément de carénage recouvrant lesdits chariots.

8. Entrée d'air variable selon l'une quelconque des revendications précédentes, dans laquelle ledit élément d'écran (13) comprend au moins une partie en matière à base de céramique.

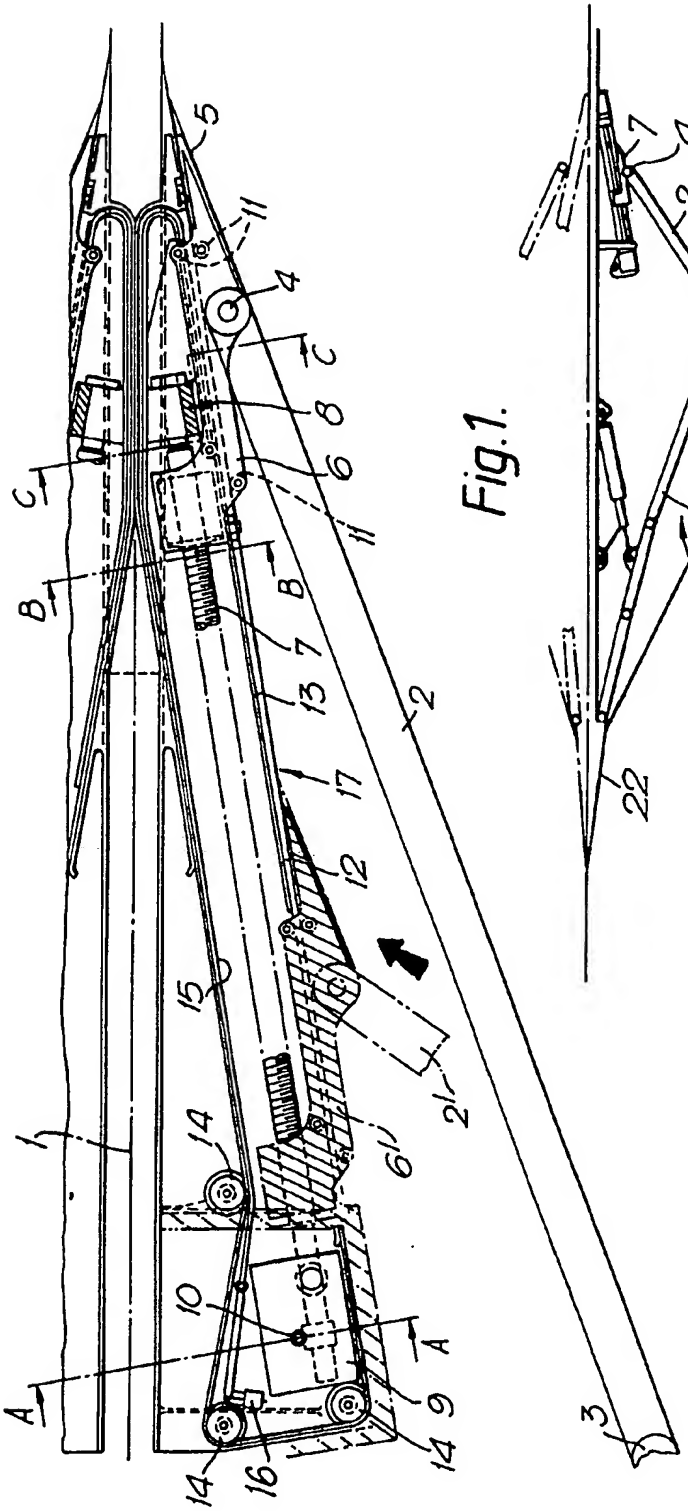
5
11
4
C
8
6
C
11
B
B
7
13
2
17
1
12
15
21
14
6
10
A
9
14
16
14
A
3

Fig.2.

7
4
2
23
21
24
20
22

Fig.1.

Fig. 3.

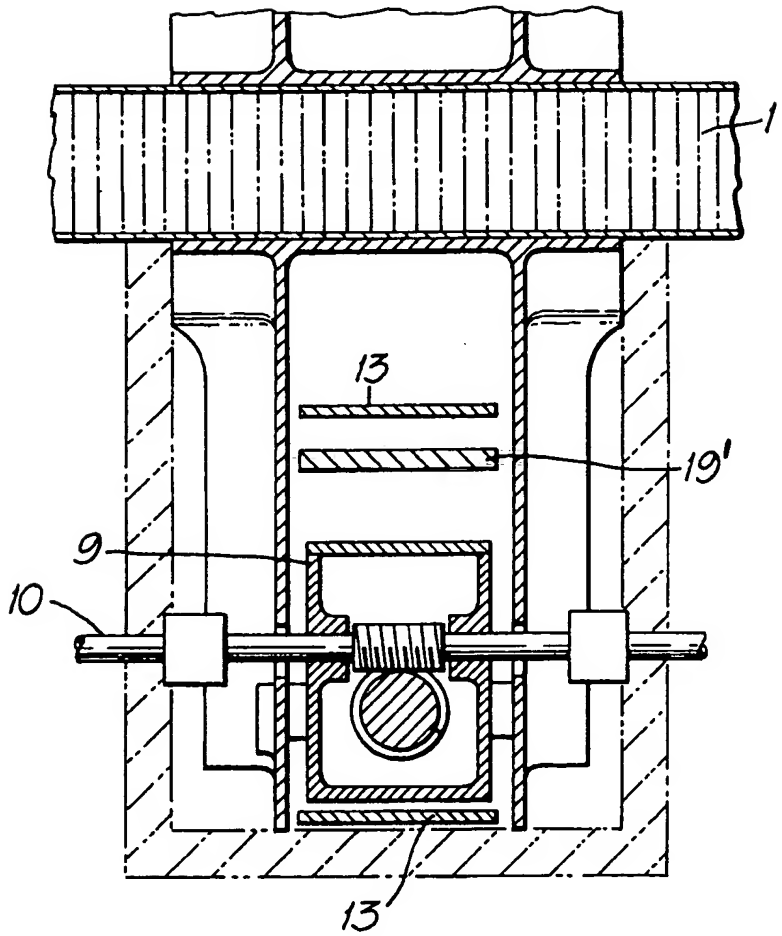

Fig.4.

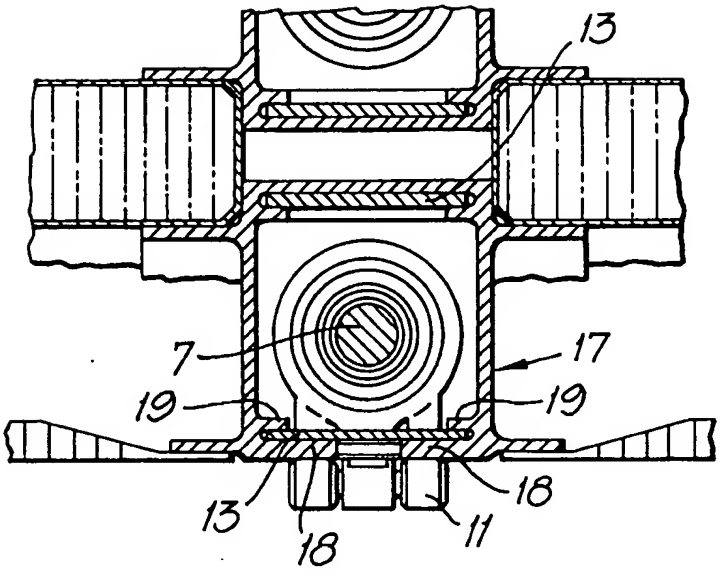

Fig.5.

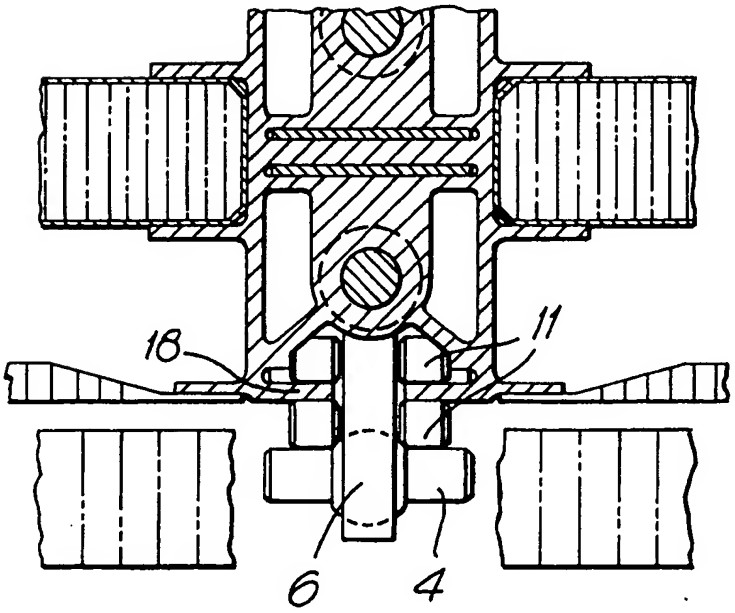

Fig.6.

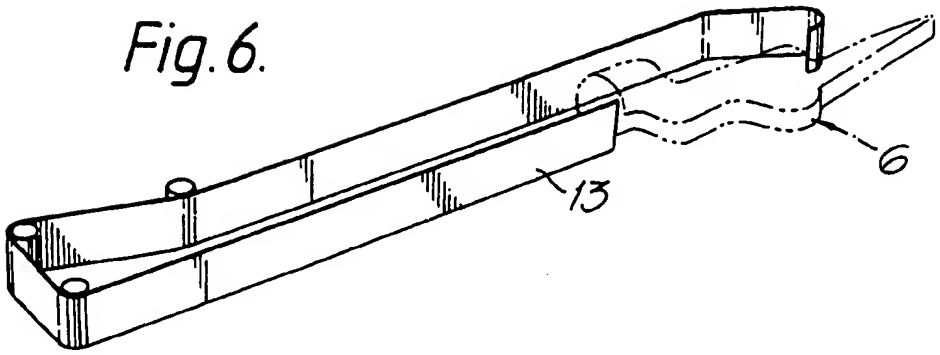

Fig.7.

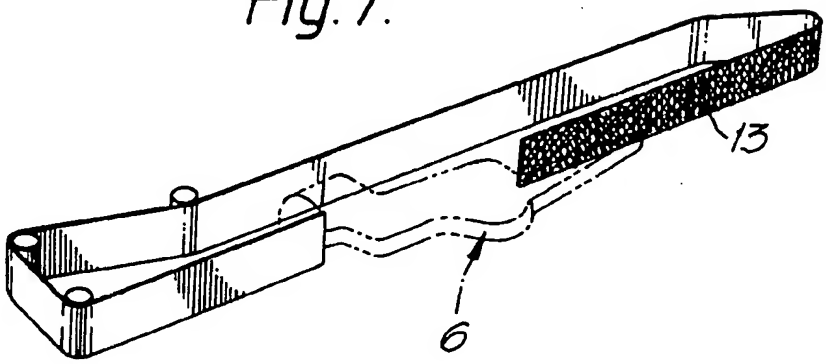

Fig.8.